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**DRAWINGS**  
**17 Sheets**

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**Serial No.** 10/072,605  
**Filing Date:** February 5, 2002  
**For:** *Direct Write™ System*

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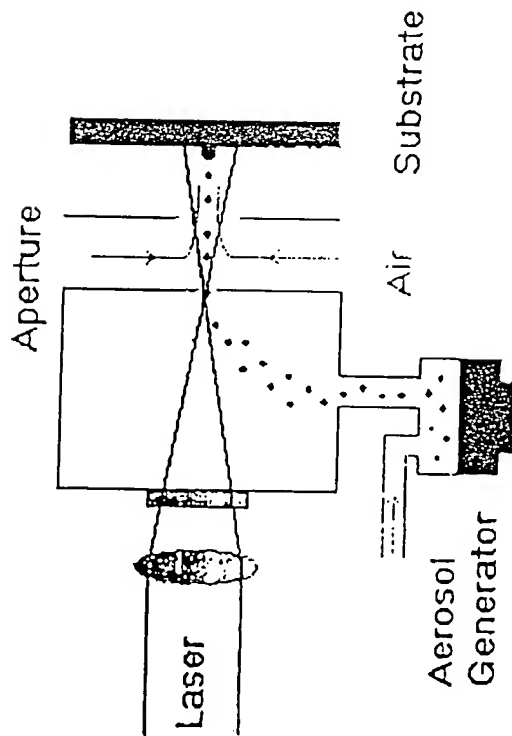
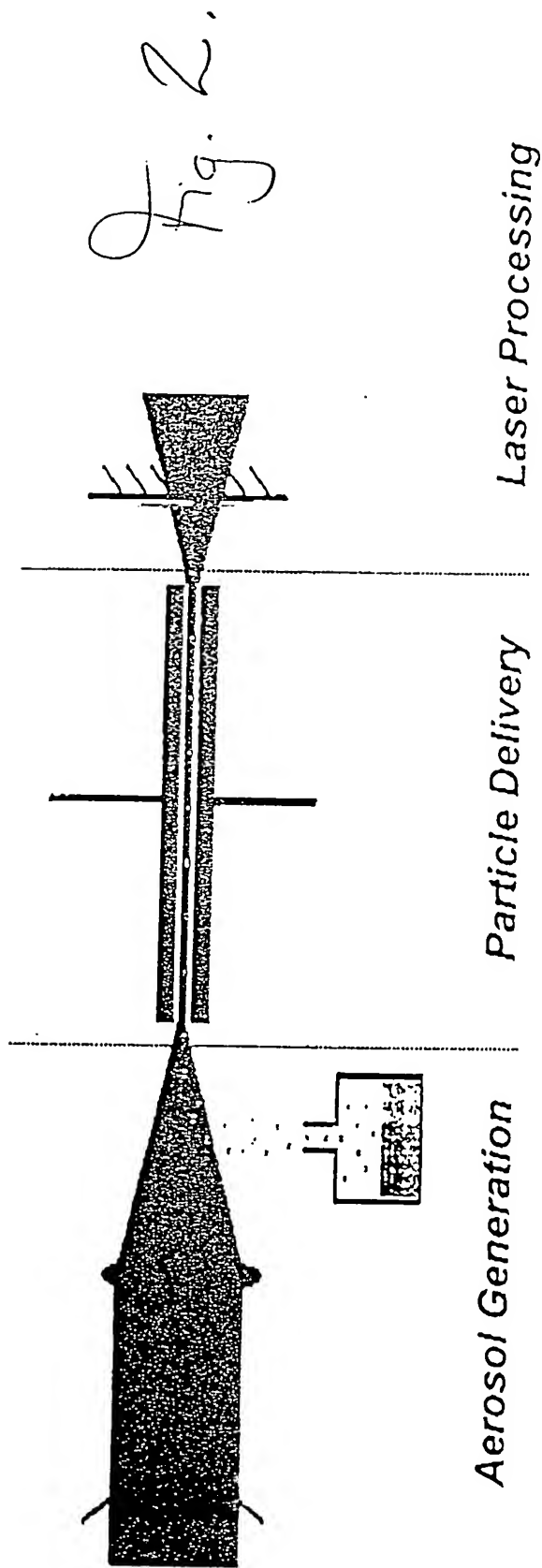


Fig. 1.

### Features

- High Velocity ( $\sim 10\text{m/s}$ )
- Variable Beam Diameter ( $10\text{ }\mu\text{m}$ )
- High Throughput ( $\sim 10^9\text{ s}^{-1}$  in  $100\text{ }\mu\text{m}$  beam)
- Reduced Clogging
- Long Working Distance ( $\sim \text{few cm}$ )
- Simultaneous Laser Treatment



### Features

- | Aerosol Generation  | Particle Delivery   | Laser Processing   |
|---|---|--|
| <ul style="list-style-type: none"> <li>• Small droplets (<math>\sim 1 \mu\text{m}</math>)</li> <li>• Dense aerosols (<math>\sim 10^{16} \text{ m}^{-3}</math>)</li> </ul> | <ul style="list-style-type: none"> <li>• Accuracy to <math>3 \mu\text{m}</math></li> <li>• Single particle to <math>10^9</math> particles/s</li> <li>• Throughput to <math>0.25 \text{ mm}^3/\text{s}</math></li> </ul> | <ul style="list-style-type: none"> <li>• Low power (<math>\sim 50 \text{ mW}</math>)</li> <li>• High scan rate (<math>\sim 1 \text{ m/s}</math>)</li> <li>• Dense, conductive materials (<math>\rho \sim 2 \times \text{bulk}</math>)</li> </ul> |

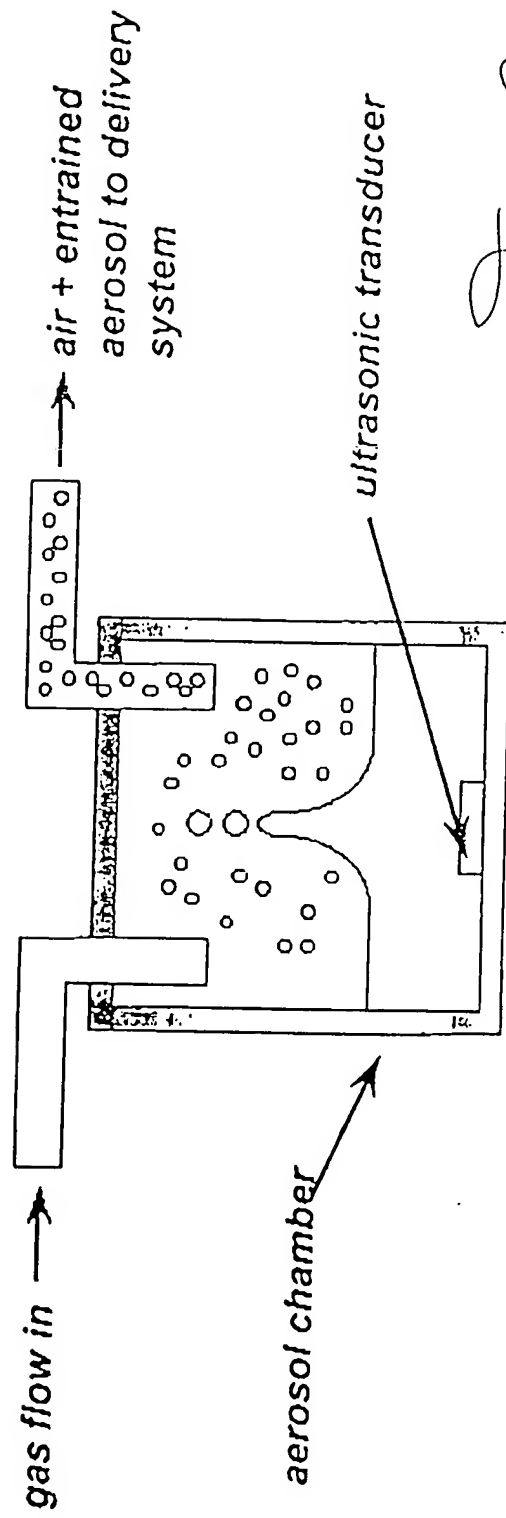


Fig. 3.

- Small droplets ( $\sim 1 \mu\text{m}$ , 1 fL)
- Dense aerosols ( $\sim 10^{16} \text{ m}^{-3}$ )
- 100  $\mu\text{L}$  minimum sample
- All solids, all precursors, or solid/precursor mixtures
- Precursor based alloys with atomic scale mixing
- Organic and biological entities in droplets (enzymes, proteins, virus, etc.)

Fig. A.

Air Jet

• Large Particles (1-30  $\mu\text{m}$ )  
High Viscosity Fluids  
Particles + Precursor binder  
animal Cells + Media  
bacteria  
virus

Compressed AirJet

Particulate in Suspension

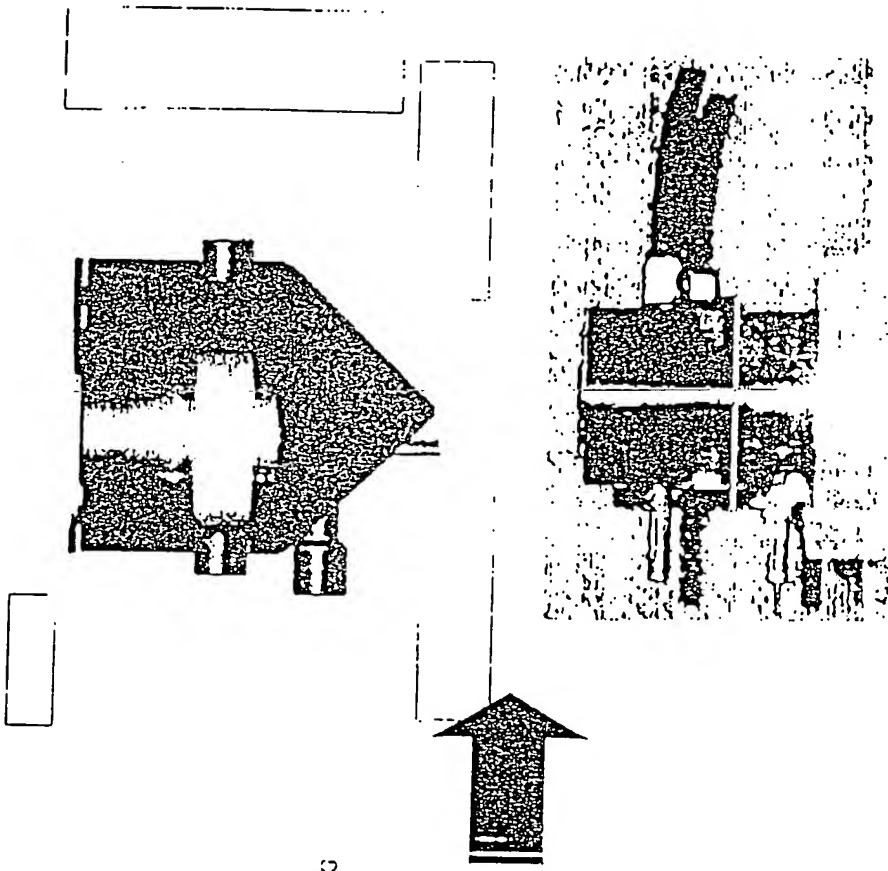
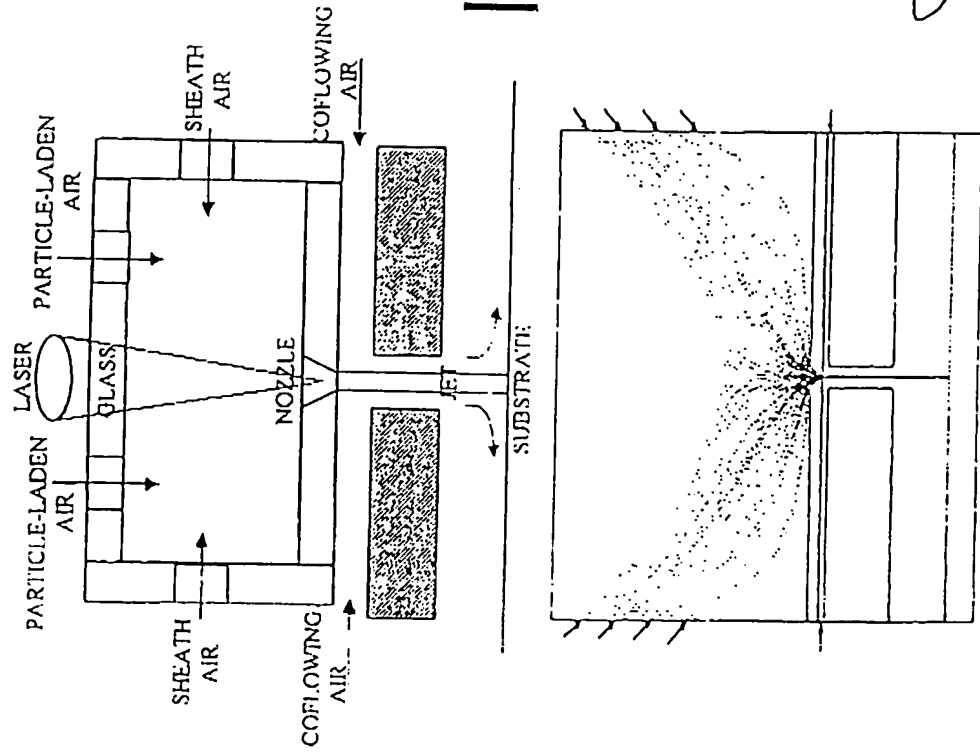


Fig. 5.

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Cascade Impaction

Gas stream carrying  
various size particles

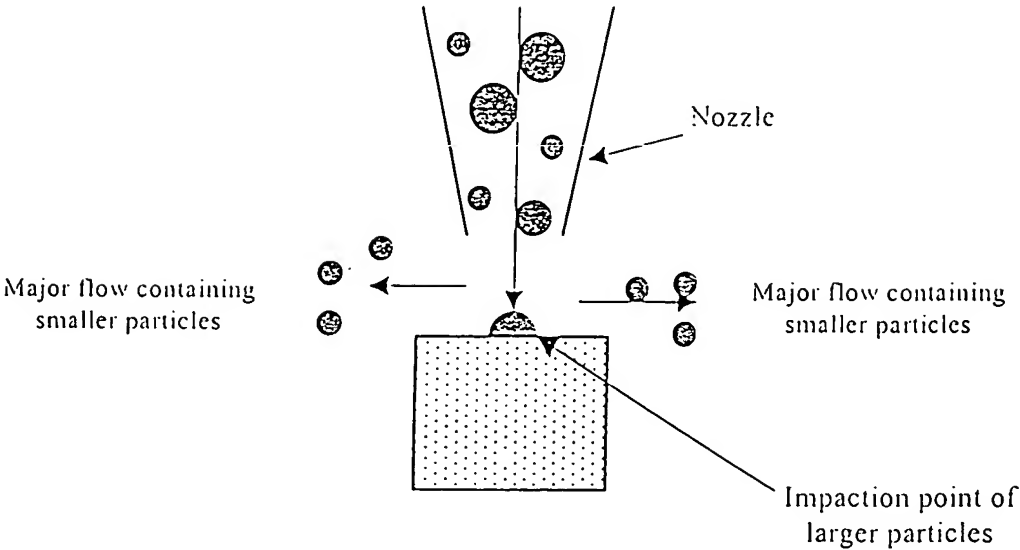
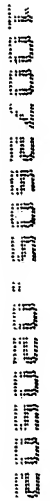


Fig. 6.



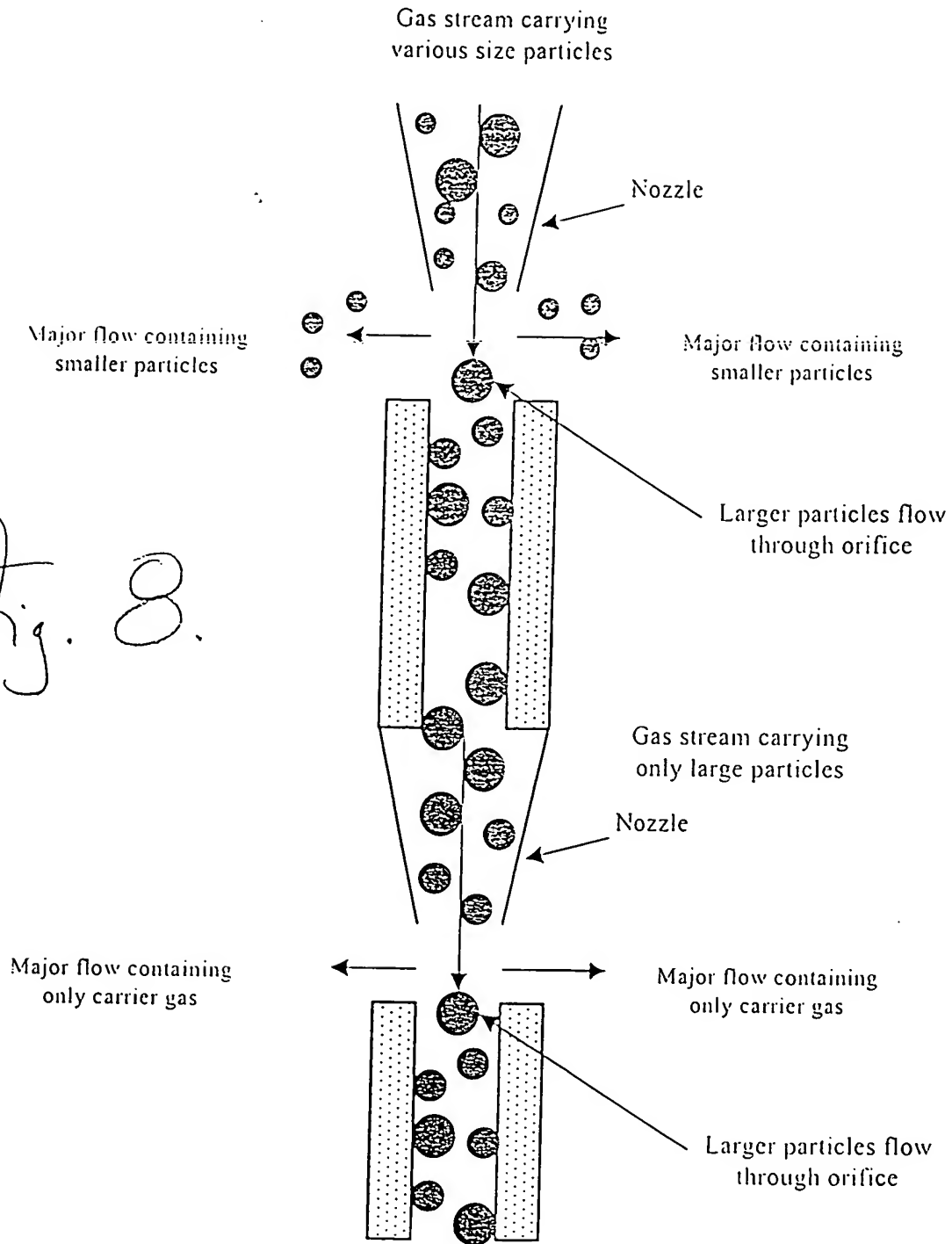
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**Figure 6.** The effect of the number of iterations ( $n$ ) on the accuracy of the proposed algorithm. The results are shown for different values of  $\alpha$  and  $\beta$ . The x-axis represents the number of iterations ( $n$ ), ranging from 0 to 100. The y-axis represents the error, ranging from 0 to 1. The legend indicates the following parameter combinations:

- $\alpha = 0.5, \beta = 0.5$  (Blue line)
- $\alpha = 0.7, \beta = 0.3$  (Orange line)
- $\alpha = 0.9, \beta = 0.1$  (Green line)
- $\alpha = 0.1, \beta = 0.9$  (Red line)

The graph shows that the error generally decreases as the number of iterations increases, with the rate of decrease being more pronounced for higher values of  $\alpha$  and lower values of  $\beta$ .

# Virtual Impactors in Series



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Fig. 8.

Particle Sorting at Atomization Unit  
& Virtual Impactors in Series

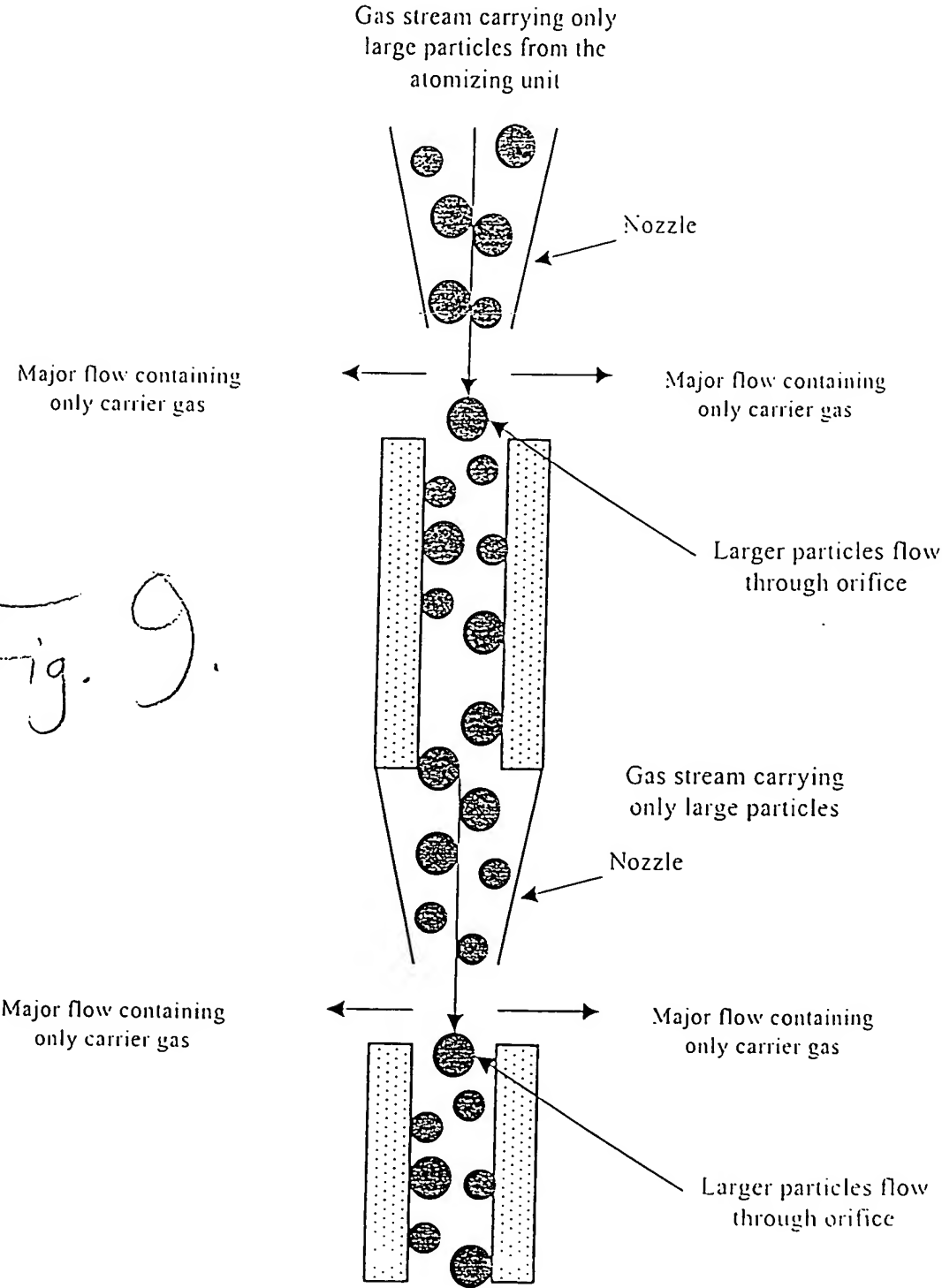
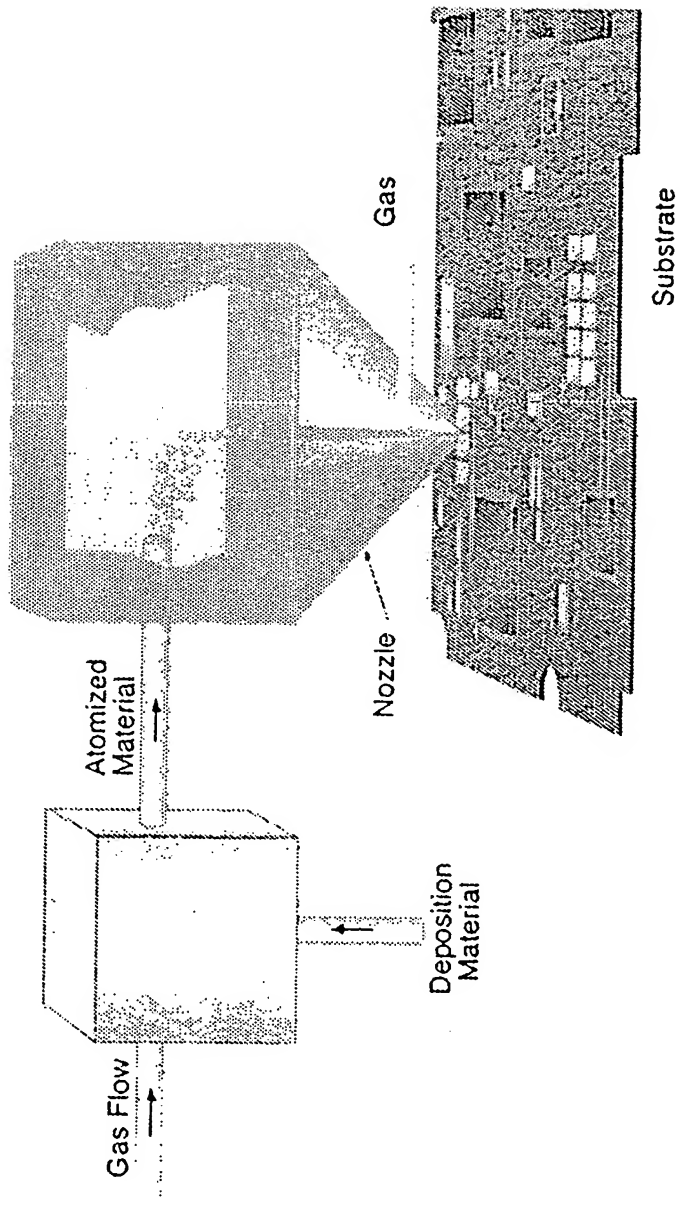


Fig. 9.

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Fig. 10.

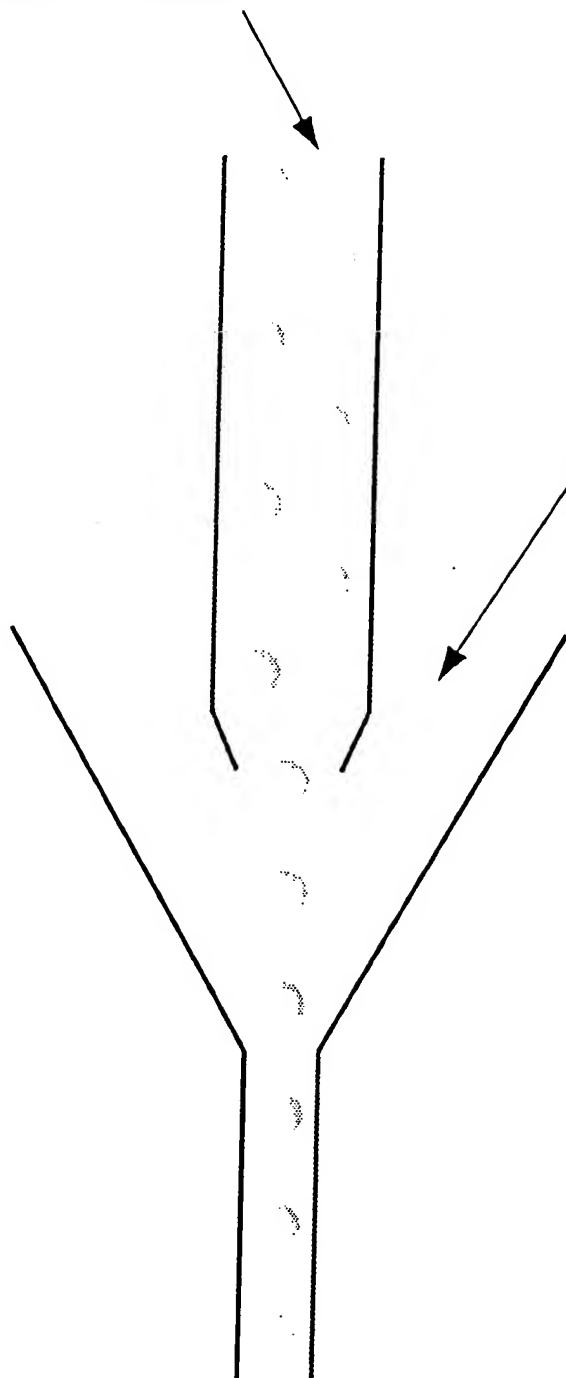
# Flow Guidance Delivery System



Aerosol Stream

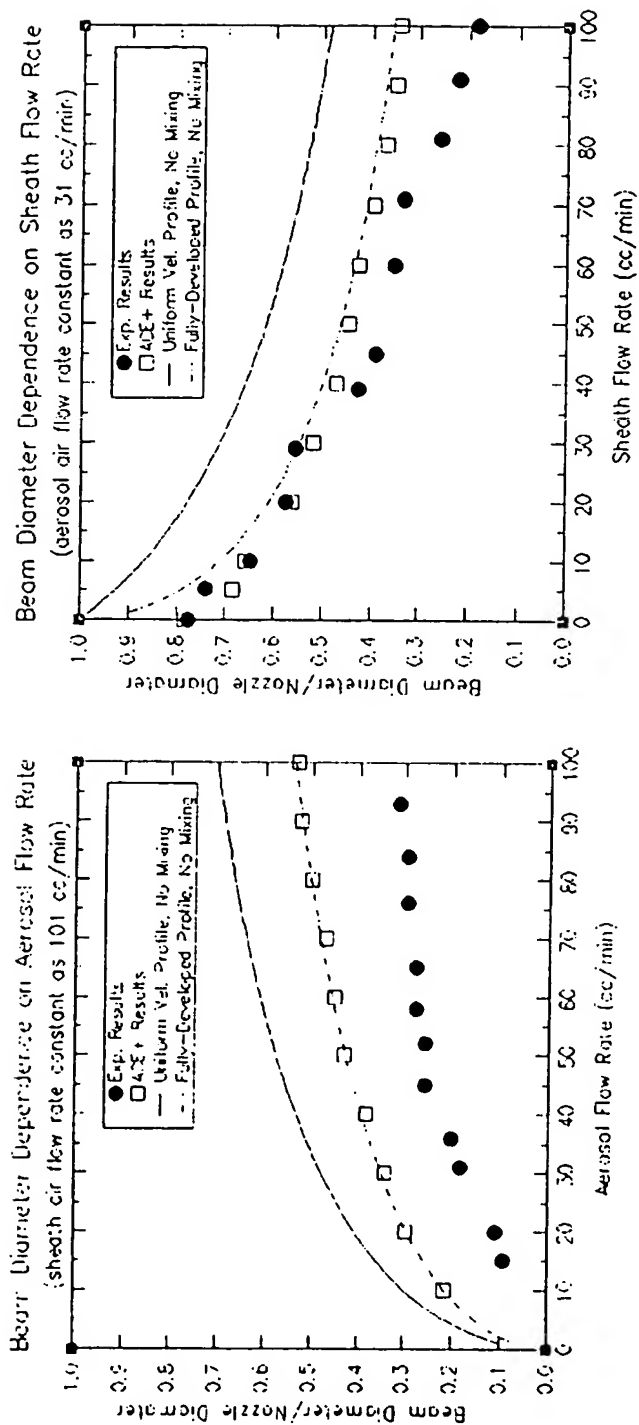
Sheath Gas

Fig. 11.



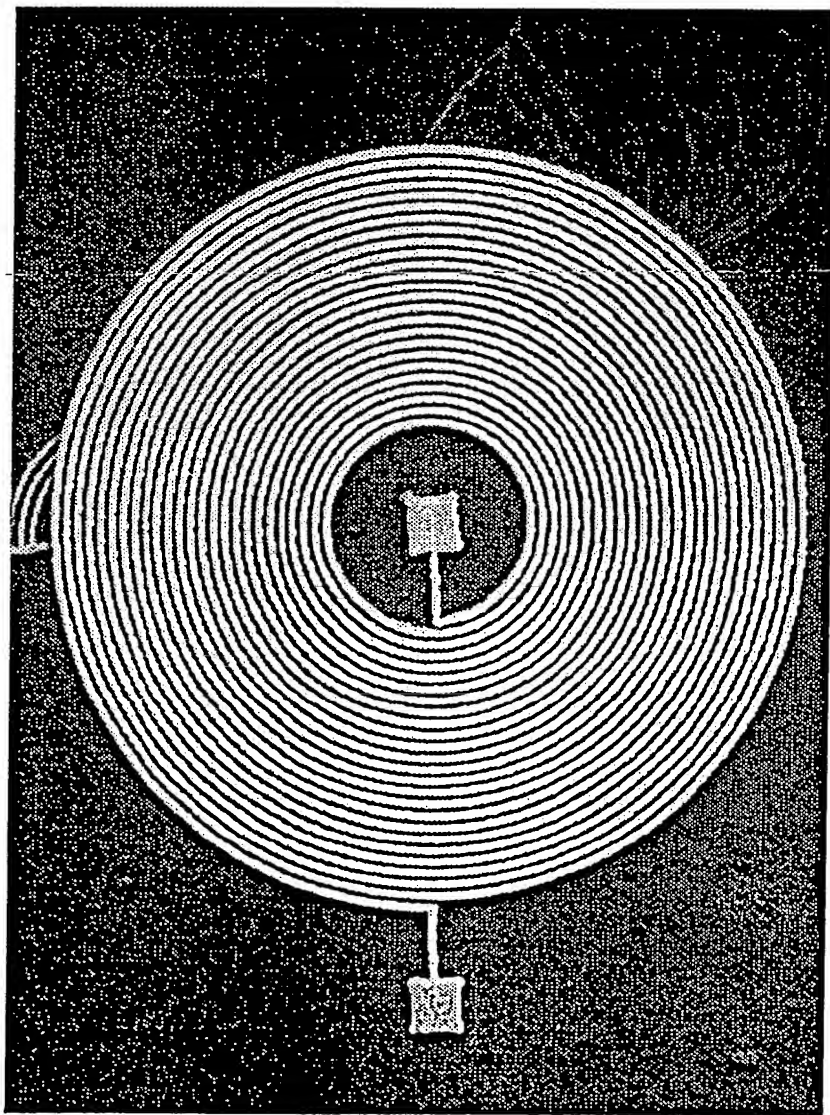
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Fig. 12.



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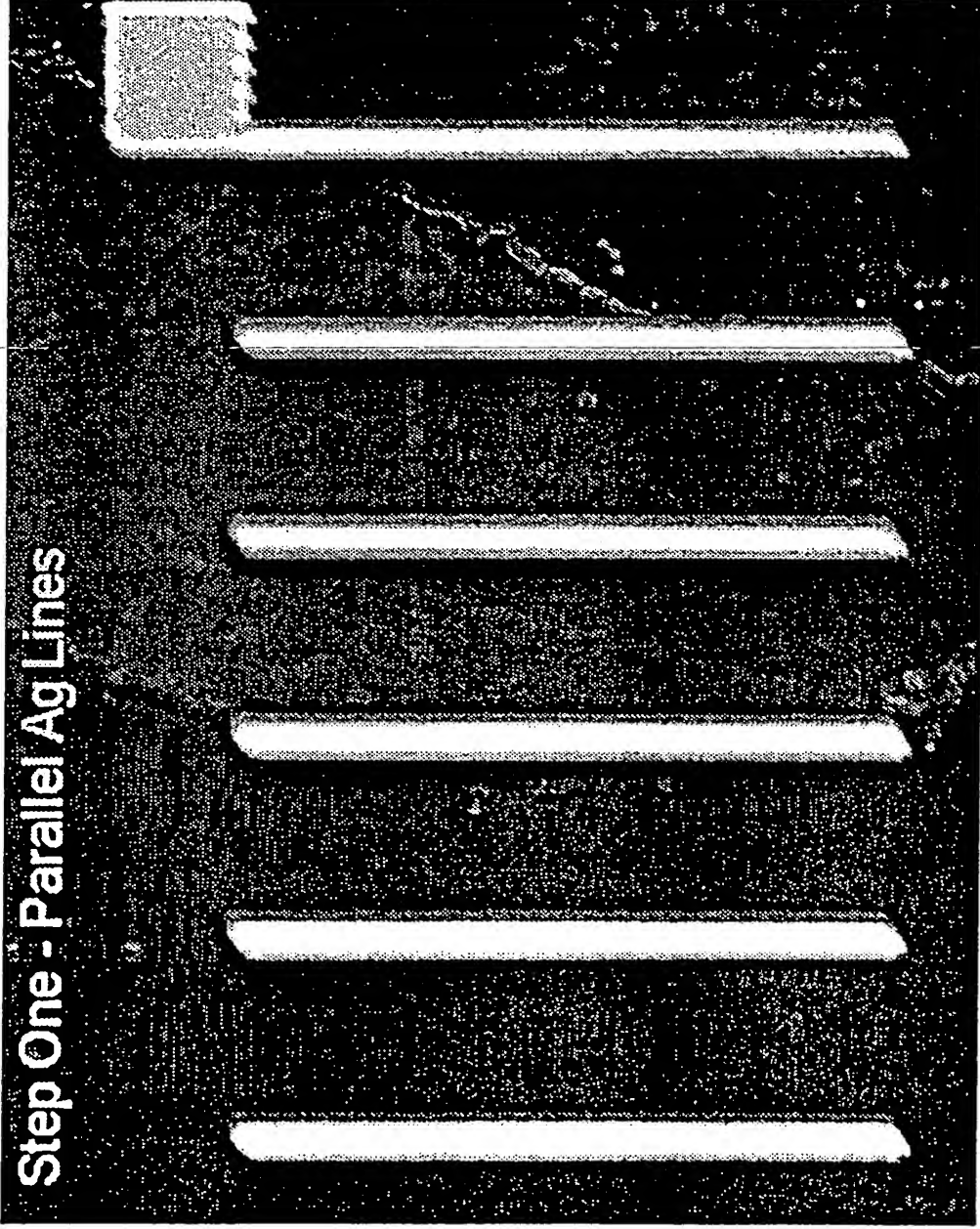
Fig. 13.



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Fig. 14.

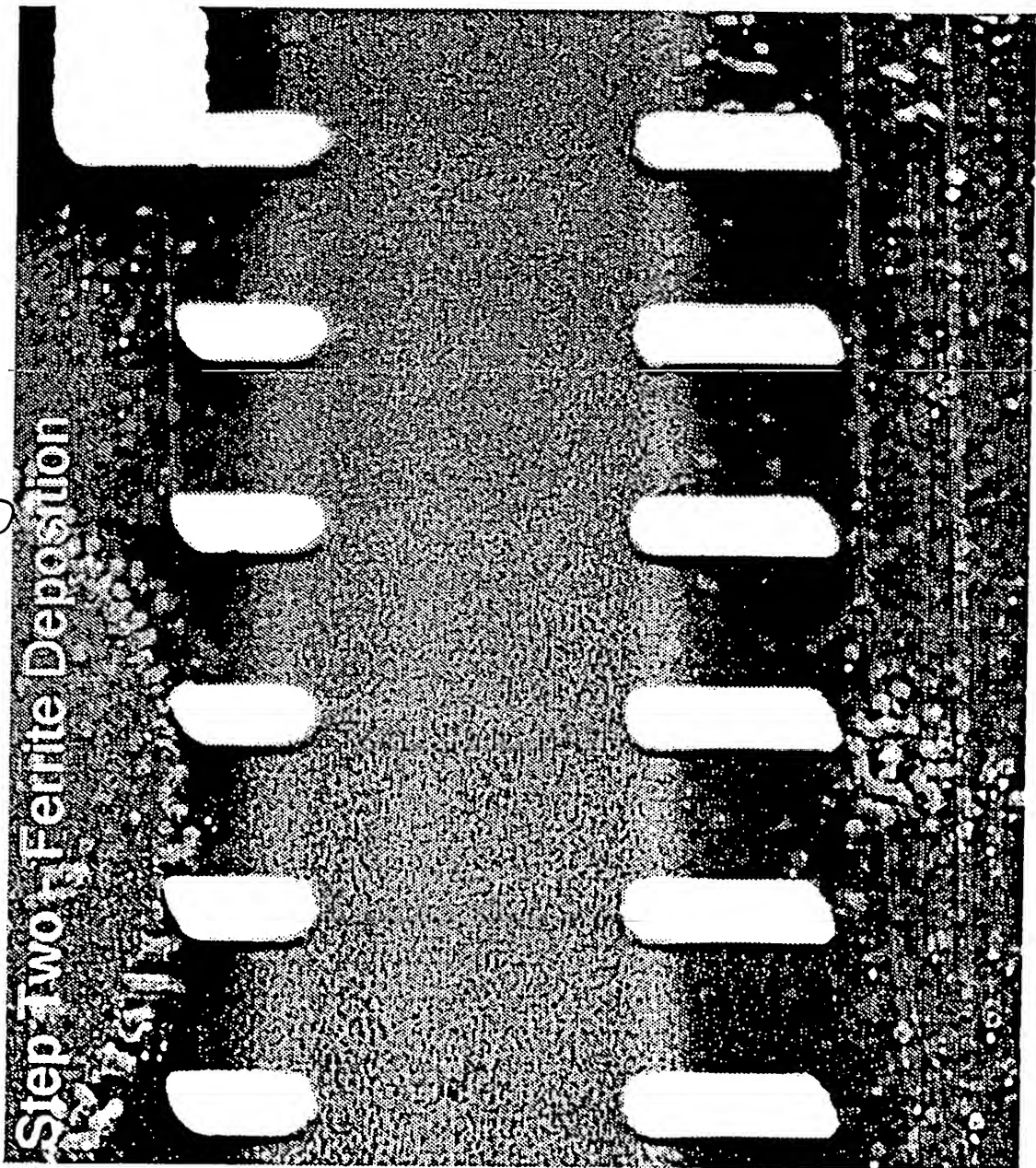
Step One - Parallel Ag Lines





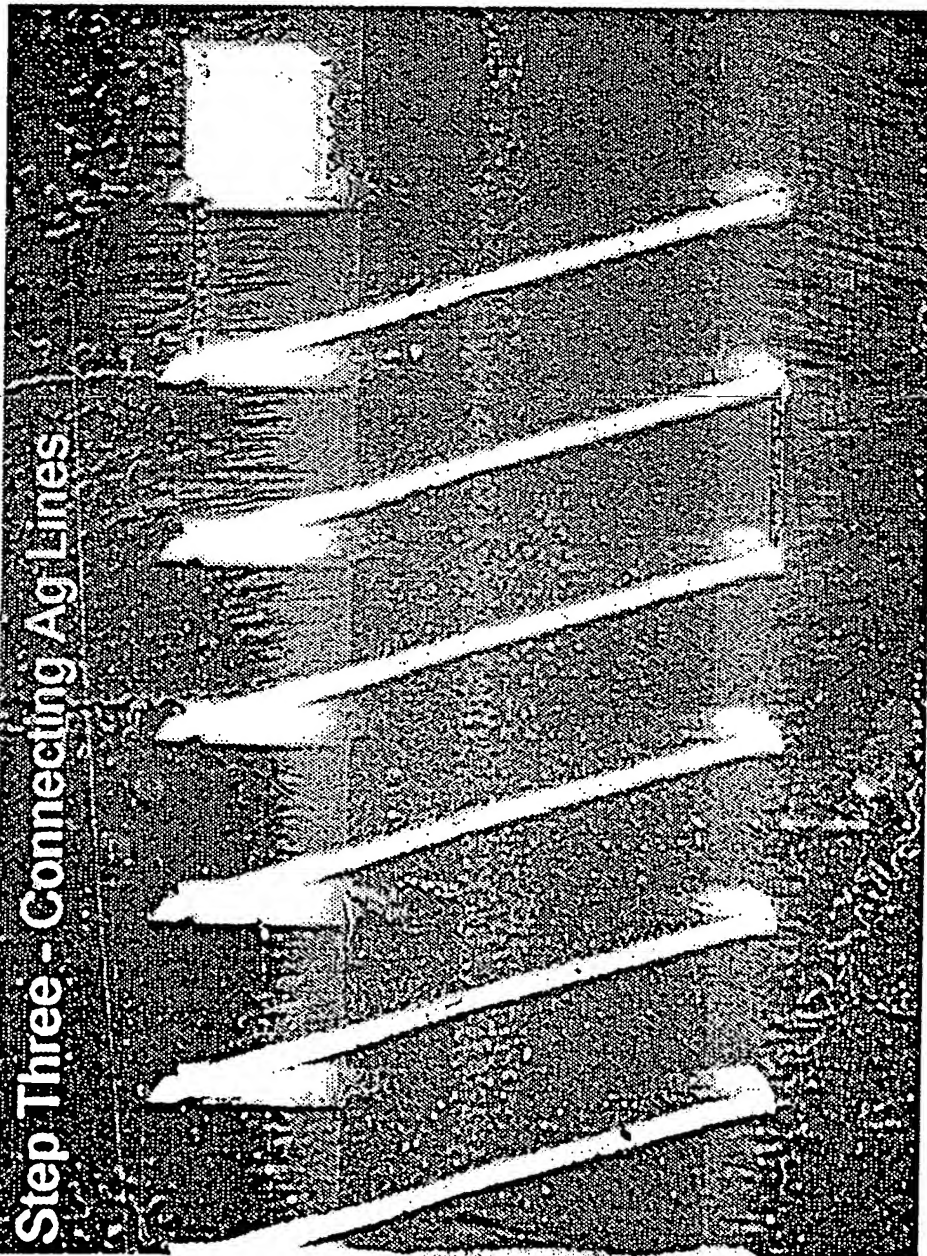
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Fig. 15.



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Fig. 16.



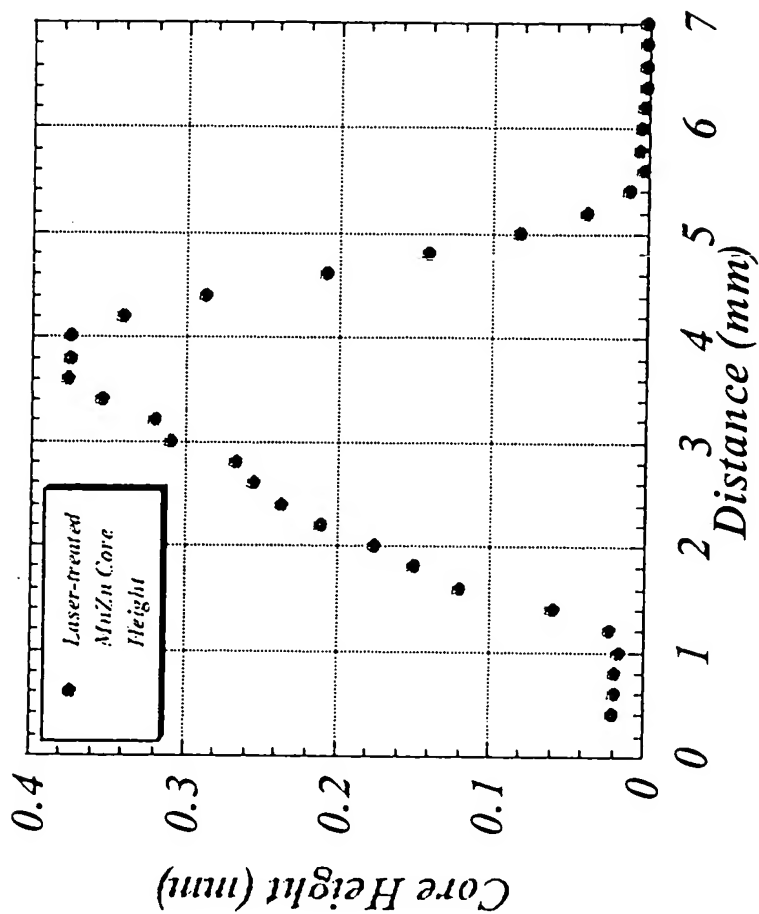


Fig. 12.